CoNNeCT Experiments

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The official link for this solicitation is: http://sbir.nasa.gov/SBIR/sbirsttr2011/solicitation/index.html

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National Aeronautics and Space Administration

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Description:

NASA has developed an on-orbit, reprogrammable, software defined radio-based (SDR) testbed facility aboard the International Space Station (ISS), to conduct a suite of experiments to advance technologies, reduce risk, and enable future mission capabilities. The Communications, Navigation, and Networking reConfigurable Testbed (CoNNeCT) provides SBIR recipients and through other mechanisms NASA, large business, other Government agencies, and academic partners the opportunity to develop and field communications, navigation, and networking technologies in the laboratory and space environment based on reconfigurable, software defined radio platforms. Each SDR is compliant with the Space Telecommunications Radio System (STRS) Architecture, NASA's common architecture for SDRs. The Testbed is installed on the truss of ISS and communicates with both NASA's Space Network via Tracking Data Relay Satellite System (TDRSS) at S-band and Ka-band and direct to/from ground systems at S-band. One SDR is capable of receiving L-band at the GPS frequencies of L1, L2, and L5.

NASA seeks innovative software experiments to run aboard CoNNeCT to demonstrate and enable future mission capability using the reconfigurable features of the software defined radios. Experiment software/firmware can run in the flight SDRs, the flight avionics computer, and on a corresponding ground SDR at the Space Network, White Sands Complex. Unique experimenter ground hardware equipment may also be used.

Experimenters will be provided with appropriate documentation (e.g., flight SDR, avionics, ground SDR) to aid their experiment application development, and may be provided access to the ground-based and flight SDRs to prepare and conduct their experiment. Access to the ground and flight system will be provided on a best effort basis and will be based on their relative priority with other approved experiments. Please note that selection for award does not guarantee flight opportunities on the ISS.

Desired capabilities include, but are not limited to, the examples below:

- Demonstration of mission applicability of SDR.

- Aspects of reconfiguration.

- Unique/efficient use of processor, FPGA, DSP resources.

  - Inter-process communications.

- Spectrum efficient technologies.

- Space internetworking.

  - Disruption Tolerant Networking.

- Position, navigation and timing (PNT) technology.

- Technologies/waveforms for formation flying.

- High data rate communications.

- Uplink antenna arraying technologies.

- Multi-access communication.

- RF sensing applications (science emulation).

- Cognitive applications.

Experimenters using ground or flight systems will be required to meet certain pre-conditions for flight including:

- Provide software/firmware deliverables suitable for flight (i.e., NASA Class C flight software).

- Document development and build environment and tools for waveform/applications.

- Provide appropriate documentation (e.g., experimenter requirements, waveform/software user's guide, ICD's) throughout the development and code deliverable process.

- Software/firmware deliverables compliant to the Space Telecommunications Radio System (STRS) Architecture, Release 1.02.1.

- Verification of performance on ground based system prior to operation on the flight system.

Methods and tools for the development of software/firmware components that is portable across multiple platforms and standards-based approaches are preferred.

Documentation for both the CoNNeCT system and STRS Architecture may be found at the following link:

(http://spaceflightsystems.grc.nasa.gov/SpaceOps/CoNNeCT/).

These documents will provide an overview of the CoNNeCT flight and ground systems, ground development and test facilities, and experiment flow. Documentation providing additional detail on the flight SDRs, hardware suite, development tools, and interfaces will be made available to successful SBIR award recipients. Note that certain documentation available to SBIR award recipients is restricted by export controls and available to U.S. citizens only.

For all above technologies, Phase I will provide experimenters time to develop and advance waveform/application architectures and designs along with detailed experiment plans. The subtopic will seek to leverage more mature waveform developments to reduce development risk in subsequent phases. The experiment plan will show a path toward Phase II software/firmware completion, ground verification process, and delivering a software/firmware and documentation package for NASA space demonstration aboard the flight SDR. Phase II will allow experimenters to complete the waveform development and demonstrate technical feasibility and basic operation of key algorithms on CoNNeCT ground-based SDR platforms and conduct their flight system experiment. Opportunities and plans should also be identified and summarized for potential commercialization.

Phase I Deliverables:

- Experiment Reference Design Mission Document.

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Waveform/application architecture and detailed design document, including plan/approach for STRS compliance.

- Experiment Plan.

- Demonstrate simulation or model of key waveform/application functions.

- Feasibility study, including simulations and measurements, proving the proposed approach to develop a given product (TRL 3-4).

Phase II Deliverables:

- Experiment Requirements Document.

- Simulation or model of waveform application.

- Demonstration of waveform/application in the laboratory on CoNNeCT breadboards or engineering models.

- Software/firmware application source and binary code and documentation. Source/binary code will be run on engineering models and/or demonstrated on-orbit in flight system (at TRL-5-7) SDRs.